# M-TRAC

**Metro Toronto Residents' Action Committee**

SUBMISSION
to the

RAILWAY TRANSPORT COMMITTEE
of the CANADIAN TRANSPORT COMMISSION

concerning

# TRANSPORTATION OF DANGEROUS COMMODITIES BY RAIL

june 1981

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**WHAT IS BELIEVABLE?**

"I THINK THAT THE DAYS OF THAT VIOLENT RUPTURE ARE ESSENTIALLY OVER."

-William J. Harris Jr., vice-president of the Association of American Railroads, testifying April 27, 1981, referring to the kind of violent explosion that followed the Mississauga derailment.

"FLUOROCARBONS ARE CARRIED TO A DEGREE IN 112 CARS AND THEY ARE UNDER FAIRLY LOW PRESSURE BUT SUBJECTED TO A FIRE, THEY COULD RUPTURE WITH SOME VIOLENCE."

-Earl Phillips, vice-president, Union Tank Car Co. of Chicago, testifying May 19, 1981.

## THE VULNERABLE CITY

Common sense dictates urgent examination of the rail affliction in central Toronto. Emergency response officials fear the prospect of another Mississauga. Rail officials know the feelings and fears of many thousands who live and work near the high-speed track bisecting the municipality. But the railways have done little to relieve those anxieties. A year and a half after the Mississauga derailment high-speed traffic of dangerous products continues unabated. The volume increases; rail safety lags.

The railways constantly reassure the public that they are conscious of safety needs, that they are pursuing safety targets within their financial means. But the public cannot perceive any change. There is widespread suspicion that much of the rail haulage profit is being reinvested elsewhere, to bring in higher returns. The railways repeatedly refer to cost effectiveness. One railway witness says he must defend the cost effectiveness even when he orders toilet paper. But then how can you judge the true cost effectiveness of one child's life? Can you place a true dollar value on human safety? That is the dilemma for the Railway Transport Committee.

There is little doubt that in any industry safety is profitable. It increases efficiency and reduces the cost of damage. In some industries the utmost safety is mandatory, aside from economic benefits and costs. Where the threat of human disaster is involved, the highest degree of safety cannot be ignored. To do otherwise would be an act of irresponsibility, edging into the realm of criminal negligence.

What is the responsibility of the railways in hauling large quantities of dangerous chemicals at high speeds through densely-populated cities? Surely the circumstances would dictate the greatest caution. And if this caution is not introduced voluntarily, surely it is the obligation of the state to enforce adherence. It is not a question of waiting for another Mississauga. As Mr. Justice Samuel Grange stated, the time for decision is long past; long overdue. Thousands of anxious Canadians look to the Railway Transport Committee for remedy.

## THE THREAT REMAINS

In Metropolitan Toronto the most serious problem lies along the Canadian Pacific North Toronto subdivision--one of the busiest freight tracks in all Canada. The concentration of population in that area is heavy, exceeding 20,000 persons per square mile. So is the haulage of dangerous products which in that area exceeds one million tons a year. Canadian Pacific has acknowledged that the situation in that area is unique. But that has not deterred the company from extracting from that narrow corridor the maximum traffic, the maximum revenues at what appears to be little more than the minimum cost.

It is a bitter reflection, a year and a half after Mississauga, that Canadian Pacific has not installed even one axle-journal scanner along 67 miles of that line--and does not intend to do so until late 1982.

Over and over again, emerency response officials note that Toronto had a narrow escape in the 1979 Mississauga derailment. Had it occurred just 23 minutes later, the resulting fire, explosions and the threatening spread of deadly chlorine would have hit the centre of the city, exacting a heavy human toll.

## THE COUNTERING VIEW

One railway response is that the emphasis is too much on the disaster that might have happened but did not, and not enough on the disaster that was avoided. After all, as one railway witness has stated, the derailment could have occurred 23 minutes earlier. The RTC may conclude that this is a callous comment. The lesson of Mississauga cannot be treated lightly. It was a narrow escape; still involving heavy costs. It was an accident we cannot afford to repeat--it is up to the state and those who act for it to take every possible means to avoid repetition.

That does not mean that we must bankrupt the railways in order to ensure a safe system. The railways form a vital part of the Canadian transport network. If in the judgment of the RTC the railways are unable to provide the financial means of implementing safety needs, then other sources must be found. But before that step is taken there must be assurance that the railways are operating efficiently and that they are not channelling profits into more lucrative enterprises elsewhere.

In the issue currently before the RTC, the question arises whether the railways can truly afford to implement the key recommendations of Mr. Justice Grange. Can they really afford to accelerate the shift to roller bearings, increased installations of hot box detectors and greater protection for dangerous-cargo containers? And if not, can they really afford to slow dangerous-cargo trains in urban areas?

## REASONABLE SAFEGUARDS

The railways argue vociferously that they cannot afford the Grange recommendations. They are too costly and largely unnecessary. They offer alternatives which they suggest are just as safe and effective but which the public both perceives and rejects as largely deceptive. Some shippers, tank car owners and other industry leaders support the railways' views. Others seem more dubious. It would appear that those who endorse the Grange recommendations are out to ruin the country. And, of course, it would appear that those who endorse the Grange recommendations are in the minority.

That would be a shallow, superficial perception. The state is well aware of the urgent need of more stringent measures; that there must be greater control over speeds, volume of traffic and haulage of dangerous goods. Given reasonable application, the Grange recommendations are affordable. Indeed, they are minimal. The key to their application is to face the problem where it is most critical. It makes no sense to allow huge loads of chemicals to be hauled through dense populations at high speeds. It makes no sense to allow this haulage to take place without the closest vigilance of track and equipment.

Communities affected by this increasing problem are awaiting action by the RTC. There is much despondency and much comment that the RTC is merely in place to protect the railways from the public. It is time to dispel that view.

**UNFORTUNATE ZONING**

The problem in Metropolitan Toronto has been compounded by unfortunate municipal zoning. That original CP North Toronto track was located in a cow pasture. And so CP tends to argue that it was there first. The implication is that if there is a danger, those alongside the track should move or bear the risks. That is an oversimplified response. It demonstrates the gap in communication and co-operation between communities and railways. Ontario Hydro could perhaps give Canadian Pacific a lesson in community relations. Canadian Pacific extracts perhaps $350 million a year in gross revenues from the Toronto area. How much consultation does Canadian Pacific undertake with the Toronto community before instituting operational changes?

In any case, the Railway Transport Committee must deal with the situation as it exists. It is unrealistic to suggest that some 70,000 or 80,000 homes, as well as schools and other institutions be removed to ensure that Canadian Pacific retains its maximum economic efficiency.

It is more reasonable to apply sensible safeguards for the good of everyone and to ease the threat of a chemical spill that would mar the conscience of all those involved in this hearing.

## MYSTERY AND BENEFITS

As this submission will seek to explain, the chemical industry is in a state of evolution. New products come on the market almost every day. Whether they are properly tested for toxicity before they are introduced to the public is questionable. We have heard statements that there simply are not enough white rats to test all the industrial chemicals flowing into the marketplace. Those chemicals which have received tests in detail probably were scrutinized through urgent public demand. Many have been tested by bodies other than the manufacturers. Recently we found instances where pesticide tests were falsified.

It is unnecessary to argue that these chemicals are needed to sustain and enhance our living standards. The chemical industry forms an essential part of our society. But no one should quarrel with the view that synthetic chemicals are dangerous until proven otherwise. The experts advise us to treat all synthetic chemicals as dangerous and to handle them with special safeguards.

Ideally, lethal chemicals should be hauled through isolated corridors, far removed from heavily-populated cities. The design of special rail corridors makes sense although it is not an issue currently before RTC. But where the RTC must deal with the situation as it exists, the introduction of the highest safeguards in heavily-populated areas would appear to be an immediate and primary essential. On that point, the Grange recommendations can also be seen as minimal when applied to the really critical areas. A slowdown to 25 miles per hour in the heaviest populated areas in all Canada is not too much to ask. And its cost would be only a fraction of what the railways estimate for the full Grange implementation.

## THE DANGER PERSISTS

There is a tendency among those who resist implementation of at least the minimum portions of the Grange recommendations to argue that if society wants to benefit from high living standards, it must accept certain risks.

For example, is the loss of, say, five school children in a chemical rail spill any different from the death of five school children in a highway crash? The loss of any life is regrettable, whether on the highways or on the track. But the spectre of a chemical rail spill in the heart of Toronto is far more ominous than a highway crash.

The spread of deadly chemicals in downtown Toronto can cause a catastrophy of awesome dimensions. Metro emergency response officials are constantly worried about that possibility. We are told by Toronto Fire Chief Bernard Bonser that Mississauga is a lesson we cannot ignore. It can happen again and it can happen in an area where no relief is possible.

Railway experts can declare that the days of violent ruptures of tank cars are over. They can praise the wonder of the latest form of thermal insulation. They can test these insulated tank cars in fires and declare there will be no more rocketing as in Mississauga, no more shooting of tank cars 2,000 or 3,000 feet from the track site. But as the RTC has already heard from one tank car operator, rips and punctures can still occur.

Regretfully, the spread of toxic fumes, liquids and other substances--as well as violent ruptures, fires and explosions--are continuing threats. They also form part of a society that must pay a price for consumer benefits.

## PRICE MULTIPLIES

In the Metropolitan Toronto area, the price is exceedingly high. While the railways maintain that dangerous goods form only a small fraction of their total national freight haulage, the chemical traffic through Toronto is far higher than the national average. Thus the risk is multiplied by this heavy population density. We have argued that a slowdown is essential. We would strongly urge the RTC to impose a rail slowdown in the heart of Toronto immediately.

The potential crisis within Metropolitan Toronto deepens with disclosures of the immense problems facing emergency response officials trying to grapple with possible evacuation of people in the event of a chemical spill. These officials have concluded that it would be virtually impossible to rescue the many thousands of people who might be affected and trapped by a downtown disaster.

Some lethal chemicals spread quickly; some settle in the soil and drinking water to impose lasting dangers. There has been much discussion about the impact of a chlorine spill which could bring death in minutes. There are many more such chemicals.

As you can see from Appendix I and Appendix III, the centre of Toronto contains a high population density exceeding 20,000 people per square mile, straddling the CP North Toronto Subdivision. In the event of a chemical disaster, available escape routes would soon be choked. Appendix II shows the maximum number of vehicles that can be handled per hour.

**"HEAVEN HELP THEM"**

Roads and Traffic Commissioner Sam Cass of Metropolitan Toronto describes the situation in this way: "If the chemical spill requires a large-scale evacuation response in, say, 30 or 40 minutes, then heaven help those involved. There is not a hope in hell of getting them out."

Under such circumstances, he says, the only logical recourse is prevention. The emphasis must be on the deterrent even to the point of overstating the case. It is this kind of situation which confronts the RTC in judging the merits of rail safety proposals. We cannot afford to wait until we see whether another Mississauga occurs. There is need for action, immediate action which the public can perceive to be positive and effective.

We strongly support hot box detectors every 10 miles in critical population areas. We strongly support the move toward roller bearings and increased tank car protection. But above all we appeal for a slowdown in lethal cargoes through critical high-density areas. There is argument that speed does not cause accidents. It also can be said that alcohol does not cause accidents. It is only when these two conditions come together or combine with other factors that we face trouble. Fire Chief Bonser argues that rail speeds do cause accidents; they also increase the extent of damage in an accident. Roads Commissioner Cass says speeds at least exacerbate the conditions which lead to serious derailments and crashes.

## GATEWAY NEEDED

Let us not mince words. The railways claim they are dedicated to public safety. They argue that slowing the trains would cause harmonic roll, a condition which Canadian Pacific says it has largely overcome but which Canadian National says is still a major problem. What is the truth of the matter? Many trains on many railroads proceed at speeds of 25 miles per hour in certain urban areas and in certain low-traffic branch lines. Yet the incidence of harmonic derailment in the low-speed range is only a tiny fraction of total derailments. Why do the railways place so much emphasis on harmonic oscillation? Is it more than another ploy to deter the RTC from imposing a rail slowdown? Surely if the railways were sincerely dedicated to pubic safety, they would have taken steps of their own to slow the lethal-cargo trains in certain critial areas without waiting for slow orders from higher authority.

Where costs are involved, it would appear that the railways operate on the principle that they will invest only where profits seem likely. Too often safety may be seen as an intangible benefit.

It is therefore up to the RTC to act; to enforce safety measures. If there is a question whether roller bearings are really effective and perhaps too costly for the resulting safety benefits, then there must be greater human vigilance to compensate. There must be greater inspection of track and equipment. There must be more frequent and adequate inspection.

## NEED FOR VIGILANCE

We are impressed with the concept of a gateway inspection system--a close inspection of trains before they enter the city. We anticipate that the gateway

inspection concept that already exists in a different form in some U.S. cities will spread to ALL major cities. With railways predicting still larger shipments of dangerous cargoes in the years ahead, the need for vigilance will obviously increase.

A proper roll-by inspection of dangerous-cargo trains before they enter the high-density areas, combined with a slowdown, track vigilance and hot-box detection, undoubtedly will reduce anxieties and risks for those who live and work in areas adjacent to the track.

Provided, of course, that there is no attempt to water down the essential list of dangerous products to the point where the safeguards become meaningless. We sense in the railways' offering of the so-called Special Dangerous Products list of 34 chemicals as a move in that direction. It probably is no accident that the list is made up mostly of products which do not move in bulk on the track.

While even small amounts of dangerous chemicals can cause widespread damage, it is important to keep in mind that many chemicals can cause trouble, even if they do not tend to spread over great distances.

In our minds, the 173-product list offered by the Canadian Transport Commission has greater merit. Our chemical experts who have examined the list suggest it is a more realistic approach to resolution of the far larger but more cumbersome Red Book list.

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## THE CHEMICAL DILEMMA

That the chemical industry is in a state of evolution is widely recognized. New products come on the market almost daily. The experts suggest that unless determined otherwise, these synthetic chemicals must be considered dangerous.

In our complex society we ought to adopt the principle that you don't ship or distribute synthetic chemicals until you are able to determine their degree of toxicity and the safest way of handling them.

We are told, and undoubtedly this can be verified, that the majority of chemicals on the commercial market have never been tested for toxicity by manufacturers. The well-known exceptions are drugs, pesticides and cosmetics.

One of the central issues before the RTC is how to define dangerous products and the best method of transporting them by rail, ensuring public safety.

A consensus would suggest that the Red Book is too lengthy, cumbersome and perhaps obsolete. We agree. Railway workers marshalling placarded cars are not necessarily experts in chemistry. They may not know the hazards of a chemical mix. They may not know the disasters that may result from a chemical spill. The list which the RTC may finally adopt should be comprehensive but within the grasp of men in the marshalling yards, on trains and in terminals.

## LAYMEN ACCUSED

The chemical industry would argue that the layman's reaction to chemical traffic is unnecessarily alarmist. After all, how many people in Canada have died as a result of chemical spills?

If we adopt that argument, emergency response authorities say, we may needlessly suffer a catastrophy of untold dimensions. They argue that the gravity of the situation cannot be overemphasized.

The only sure way of coming to grips with the chemical age is to concentrate on deterrents. Reasonable safety is insurance we can and must afford.

Mr. Justice Grange recommended what we consider the minimal approach to transport improvement. The railways and the shippers argue that the cost is too high. We hope to point to an approach which may not be totally satisfactory but may still provide some measure of relief, at least for the highly-populated cities.

This compromise must involve a number of factors: proper inspection, proper placarding, traffic caution and a dangerous products list that is comprehensive but not overwhelming.

We are not impressed with the attention the railways give to the so-called 34 list. This list, known as the Special Dangerous Products list, includes some substances that can cause widespread damage. It may be only incidental that most of these products do not figure heavily in railway revenues. Most of these products are not carried in large quantities by rail.

We are more impressed with the Canadian Transport Commission's offering of a list of 173 products designated by traffic volume.

**LIST RECOMMENDED**

Our chemical experts have examined this 173-product list and recommend its acceptance. We understand that other organizations within the government are studying this problem and that other lists may be brought before the RTC. We strongly urge the RTC to reject any attempt to water down the list to the point where it loses safety effectiveness.

In arguing that all synthetic chemicals must be considered potentially dangerous, we would refer you to the views of Dr. Donald Chant and Dr. Ross Hall summerized in Appendix IV. We have consulted many authorities. There can be no argument that we have correctly emphasized the gravity of the situation. We have searched for reasons why manufacturers have not spent more time studying the toxicity of industrial chemicals. The answer appears to be: "Why spend money when you don't have to?"

Where some synthetic chemicals such as chlorine have been tested for toxicity, the main thrust seems to have been undertaken by organizations other than the manufacturers.

Dr. James Stopps of the University of Toronto comments: "All chemicals released to the environment in an uncontrolled way are harmful. We need constant updating on the effects of new chemicals moved into the commercial stream."

In a proposal for a Canadian Centre for Toxicology, Dr. Freeman McEwen considered the relationship between the chemical market and the public.

McEwen, who is Chairman of Environmental Biology at the University of Guelph, mentioned in a steering committee statement that "because of the lack of adequate research, monitoring and regulation, the public is rapidly losing confidence in the institutional framework for controlling the harmful effects of toxic chemicals. The public views industry with suspicion and distrust and is rapidly moving to perceive government in the same light."[1]

With many government bodies involved in the control and administration of dangerous product uses, we may be facing a period of confusion and overlapping jurisdiction in the safe and efficient handling in this complex field.

## NINE CLASSES LISTED

The Transportation of Dangerous Goods Act defines nine classes of dangerous goods: explosives, gases, flammable liquids, flammable solids, oxidizing substances, poisonous and infectious substances, radioactive materials, corrosives and miscellaneous substances and organisms.

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[1] Probe Post Vol. 3(4), Jan-Feb. 1981

Draft code IV for the transportation of dangerous goods deals with four general areas: Regulations, National Standards, Accepted Practices and Information. Each of these areas is comprehensively delineated. Each class of dangerous good is subcategorized for purposes of labelling and placarding and hazard characteristics are defined, particularly for classes 3, 6 and 8 in regard to oral, dermal and inhalation toxicity. Unfortunately, only Class 1, explosives, is cross-referenced according to compatability. The compatability of chemicals within classes 2 - 9 is not described. The between class compatability of chemicals is not described, nor are regulations, standards, practices or information about compatability provided.

We are informed that there is jurisdictional overlap with the Pesticides Control Products Act, the Food and Drug Act, the Atomic Energy Control Act, and the Explosives Act. We are aware that jurisdiction for dangerous goods at various levels of manufacture, transport, utilization and waste disposal come under myriad numbers of federal, provincial and even municipal jurisdictional statues.

We are also informed that for regulatory purposes of the RTC and the Dangerous Goods Branch, as well as for other regulatory agencies, there is little if any differentiation between chemicals as raw materials (essentially in pure form), chemicals as end or by-products and chemicals as waste.

Apart from this tangled skein of definition and jurisdiction, we are deeply disturbed by the grave shortcomings relating to the enforcement procedures envisaged by the Transportation of Dangerous Goods Act.

At issue is who is in charge. This responsibility operates at many levels. The first person in charge may be the shipper of a chemical. It must safely enter the system. The next is the carrier, but more specifically the carrier's representative who marshalls this chemical. He or she, whether dispatcher, yardman, assistant yardman or trainman, is rarely a chemist, a chemical engineer or a toxicologist. However, he or she is in charge of deciding on the compatability of two or more chemicals on any given train. While we understand that some rules exist regarding the mixing and buffering of certain classes of commodities, we are unaware of any rules regarding compatability of chemicals, either within or between classes. Nor are we reassured by draft rules currently under consideration by the Dangerous Goods Branch of Transport Canada in this respect. Class rules yes, compatability rules, particularly within and between classes, no.

## ARE WE ALARMISTS?

The gravity of the situation must be stressed at the risk of being labelled alarmists. At every level of the food chain, from single-celled organisms to the human body, no synthetic chemical can remain neutral: each chemical is either a nutrient or a poison.

When we broaden our focus from micro-organisms to entire ecosystems, we confront a sustained and ever-increasing invasion of foreign man-made chemicals which uncontrollably permeate all living processes. The toxic effects of the majority of these chemicals have been inadequately investigated. Whether as raw material, by-product or waste, these chemicals are incrementally integrated into the metabolism of our bodies.

We say that until proven otherwise, every synthetic chemical produced must be regarded as a poison and the best safeguards man can devise must be introduced to protect the public from the threat of mishap in chemical transport.

To act otherwise, on the part of public bodies, could be considered tantamount to negligence.

Everything possible must be done to ensure that the human body is not contaminated. This is not an alarmist argument. This is just common sense.

To move highly lethal substances through heavily-populated areas at high speeds is an irresponsible act. To advocate and abet such an act is not in the public interest nor is it an act of good corporate citizenship.

The minimum safeguards suggested by Mr. Justice Grange should be readily accepted by the chemical industry if it is sincerely dedicated to public safety.

Professor Colin McArthur of York University comments: "It is accepted that the transportation of highly reactive and toxic commodities is necessary to the maintenance of our industrial society. The chemical industry by its nature must locate its major manufacturing facilities in a relatively small number of large complexes. Not only does economy of scale appear to be crucial in this industry, but the product of one operation becomes the feedstock of another. It would not be economical for every municipality to have its own facility for producing chlorine for its water supply, for example. Accordingly, materials produced at major manufacturing centres must be transported to points of utilization.

"The serious damage to property and risk to health and life that many of these materials can cause, if uncontrollably released to the environment, has given rise to alarm. It is the purpose of this document to comment on the nature of some representative dangerous materials and some of the dangers they could pose because of their physical and chemical properties.

"Many of the materials transported are very reactive (or contain large amounts of 'built-in' energy). It is this property that makes them useful as manufacturing intermediates. It is not until the final chemical transformation occurs that produces a product familiar to the domestic consumer, that relative stability occurs. In the event of an accident in which reactive materials are released to the environment in an uncontrolled fashion, uncontrolled reactions can occur. Depending on the particular materials in question, such reactions may lead to violent explosions, and fires spreading far and wide. Some products are gases which, when not contained, move uncontrollably and mix with air. Others may be liquids that, say, are water soluble, and in large quantities can seep into sources of municipal water supply.

"When humans are exposed, the orderly chemistry that constitutes life (the human body of course is chemical and fundamentally molecular itself) can be seriously disrupted by reaction with reactive materials. The result, depending on the nature of the exposure, may be injury, acute or chronic illness, or death. Another consequence of the high reactivity of many materials being transported, is that there may be reaction between materials from different tank cars, which in an uncontrolled situation (including say, very high temperatures and loss of ability to confine materials), the product mix that could result could contain a myriad of different products. (The high temperature reaction of chlorine and

propane at the Mississauga derailment appears to have generated a large variety of organo-chlorine compounds as a class, many of them are known to be carcinogenic even though they appear to be less reactive otherwise, than the chlorine and hydrocarbons from which they are derived. (See Appendix V).

"The concentrations that produce toxic effects in many cases are so low that one tank car losing its contents, in certain situations, could be as dangerous as several."

## Examples of Materials Transported and Some of their Hazards

### Propone, Butane

These hydrocarbons are extremely reactive with oxygen as well as with chlorine. Violent explosions and BLEVES (boiling liquid expanding vapour explosions) have occurred. Fragments of metal can be propelled at enormous velocities. Explosions of such magnitudes, of course, can kill, dismember, destroy nearby structures, and start secondary fires.

### Chlorine

Chlorine (as elemental $Cl_2$) is an extremely reactive material and very toxic. It is shipped in tank cars under pressure as a liquid. If the tank car should rupture, the contents become exposed to atmospheric pressure which allows the liquid to convert to gaseous chlorine with a concommitant expansion in volume by a factor of 460. The density of this gas is greater than that of air, so higher concentrations tend to form nearer the ground level. A concentration of 50 ppm

can cause serious damage to humans even with short exposures (a few minutes). Brief exposures at 1000 ppm may be fatal. These properties led chlorine to be used as a war gas in World War I.

The potential for contamination of the environment (including, for example, drinking water) with organo-chlorine compounds formed from reaction of chlorine with organic materials should be considered.

Insecticides

The major classes of insecticides are the organo-chlorine compounds and the cholinesterase inhibitors (organo phosphorus compounds).

Most of the organo-chlorine compounds have been removed from the market. They are fat soluble and so move up the food chain. They are relatively stable (or their metabolites or degradation products are) and, consequently, persist in the environment. The discovery that some of these compounds are carcinogenic in experimental animals, as are other organo-chlorine compounds, has contributed to the reduction in the number of organo-chlorine compounds used as pesticides.

The cholinesterase inhibitors kill insects by inhibiting transmission of nerve impulses. The chemistry involved in nerve transmission (and its blocking by cholinesterase inhibitors) in humans is essentially the same as that in insects. Indeed the history of their development is related to that of nerve gases in World War II. Some fatalities have resulted from accidental exposure to organo-

phosphorus compounds. In the event that pesticides become part of the "soup" in an explosion from other cargo, the danger to populations exposed to fumes and vapours could be most acute.

Phenol

Phenol was spilled in large quantities from a train derailment in Wisconsin, near East Troy in 1974. Its water solubility led to contamination of drinking water, particularly after a decision was made to flush the spil site with water a few months after the accident. Illnesses, attributable to phenol poisoning, resulted. Diarrhea, dark urine, and sores and burning of the mouth are typical of phenol poisoning.

Vinyl Chloride

Vinyl chloride is a volatile liquid (b.p. -13.4°C) or a gas at ambient pressures and temperatures. It is of moderate acute toxicity. In high concentrations it can act as an anaesthetic.

In 1974, three cases of a rare type of liver cancer (angiosarcoma) appeared amongst workers in a vinyl chloride polymerization plant in Louisville, Kentucky. Since then, a number of additional cases of this disease has appeared in plants in other locations. The latency period from initial exposure to appearance of disease has been estimated at about 10 years.

Vinyl chloride has now been demonstrated to be carcinogenic in experimental animals. Further, the chemistry involved in metabolizing vinyl chloride is now sufficiently well understood to explain the carcinogenic action.

Indeed, other organo-chlorine compounds with similar molecular features appear to react in a similar manner during metabolism. It appears that these types of componds are converted to carcinogenic metabolites by enzymes in the body.

Vinyl chloride is flammable. A train derailment near Batavia, N.Y., resulted in an explosion and fire involving a tank car of vinyl chloride. (Details of this accident and the derailment near Winnipeg, involving vinyl chloride, may be worth examining).

Conclusion

The few examples chosen here illustrate the potential dangers of a variety of compounds that could exist should highly reactive (including highly toxic) materials be released uncontrollably. Not only must the dangers of the short term consequences (acute and suddenly developed illnesses, deaths from acute intoxication, burns, injury, property damage, etc.) but also the less well appreciated and less well understood long term effects of sub-acute exposures over longer periods of time.

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## AFFORDABLE SAFETY

We all have agreed that safety is essential. The split is on the question of what costs are bearable. The problem for the RTC is that it has been confronted with a slowdown recommendation difficult to implement.

Undoubtedly, Mr. Justice Grange had good intentions when he suggested that the slowdown encompass high-density areas. But, almost as an afterthought, he added that high density should include concentrations of 500 persons or more.

This would include a long string of villages across the country and lead to so many slowdowns that the railways could seriously argue that efficiency has been destroyed to the detriment of the public as well as the railways and other major industries.

We have agreed that the 500-person concept is unrealistic. One major railway, Canadian National, even reached out beyond the track to include villages a mile away as part of the economic profile for implementing the Grange slowdown. This all-embracing concept merely inflated the total potential cost. The RTC in all good faith could not implement such a massive slowdown without imposing a heavy economic burden on the country.

Nontheless, more narrowly defined, the thrust of Mr. Justice Grange's recommendation can be found acceptable. We believe it should be approached from a position of vulnerability--the ability of the community to evacuate its people in the event of a disastrous chemical spill.

**THOUSANDS CONCERNED**

Where are these critical areas? They exist in the high-density areas of Toronto, for one. They exist in other cities as well but we must be concerned with our primary objective of bringing relief to the tens of thousands of people anxious about another Mississauga derailment.

We cannot give you an exact figure of what it would cost to implement this Grange recommendation in central Toronto. We had hoped the railways would provide such a figure as a possible search for an acceptable compromise. But they shy away from such a solution. We believe that if a slowdown is applied to a minimum number of critical areas, the cost would be only a fraction of what the railways estimate for the overall Grange proposals.

There are other costs involved in the Grange recommendations. He urged a speed-up in tank car improvements and a faster changeover to roller bearings from plain bearings on trains carrying dangerous cargoes. In the absence of contrary figures, we can only accept the cost estimates of the railways and the tank car owners of such improvements and changeovers.

We are not totally impressed with the full safety value of roller bearings since we are told that while they may last longer, they may burn off faster. We accept that roller bearings may be an improvement but that human vigilance must be maintained. We also accept the concept of more hot box detectors, considering their cost to be merely another aspect of normal train operations. We would agree with Mr. Justice Grange that in the built-up areas these hot box detectors should be placed no more than 20 miles apart. In the critical areas they should be spaced no more than 10 miles apart.

## ALARM SPREADS

The railways have raised many alarms that shipping charges would be doubled or tripled if the Grange recommendations are imposed. We believe the need for such high tariffs can be challenged. We agree safety involves cost but when applied in a sensible manner to critical areas, the costs can be absorbed without major impact on the economic structure of the country.

There seems to be room for greater railway economies based on existing operations. For example, the railways may find they can increase efficiency by reducing terminal time in relation to on-line time.

It is widely recognized that terminal costs can constitute a significant factor in total rail charges. Terminal costs may be as low as 20% of the total for some long-distance carriers and as high as 80% of the total in short-haul. We are cognisant that terminal costs vary with the total traffic mileage.

In terms of the Grange recommendations, it is well known that the chemical traffic is one of the most lucrative sources of railway revenue--despite the fact there are inherent dangers in such traffic. It has been said that the most profitable train on wheels is a long, fast, high-tonnage chemical train travelling great distances without interruption.

## LENGTHS QUESTIONED

Slowing the dangerous cargo trains, the railways argue, will simply bring more congestion to areas already heavily congested. That argument would be enhanced if the dangerous cargo trains also are reduced to 4,000 feet.
Mr. Justice Grange was concerned that longer trains would reduce hot box

detection. We accept that it may be difficult to reduce trains to 4,000 feet if the essential need is to provide a slowdown, at least in the critical areas.

Somehow, we must live with a compromise. In slowing the trains we inject caution, an essential element of safety. Adding the element of reduced train lengths may be a luxury we cannot afford. In the long run these fears of increased congestion must lead the railways to consider new routes. We strongly support the idea of an alternative to the North Toronto subdivision which causes so much anxiety to many thousands of people in Toronto. From time to time, there have been proposals for relocating that CP subdivision. The railway has shown no encouraging response.

The railways argue that if they are forced to abide by the Grange recommendations, the economic burden would force shippers to switch dangerous cargoes to the highways. We question whether in fact that will result. Transporting by rail is still one of the cheapest carrier services provided. We would not encourage the shift of dangerous cargoes to the highways.

## PROFITS SHIFTED

The question of what is affordable brings up the issue of what railways do with their profits. Is it more lucrative for them to invest in new rolling stock, track and safety equipment or can they gain higher returns by shifting surplus funds into other ventures? It may be a matter of concern that funds are being shifted elsewhere while safety measures in the railway system are ignored or delayed.

There is another point. The benefits of safety spill over beyond the railway's pocket books. It is relatively simple to conclude that a safe operation is an efficient operation and the greater the efficiency the greater the possibility of profits. The cost of a disaster brings not only grief to those involved but may also damage the economic structure of the railways. Undoubtedly the railways will say that most risks are covered by insurance and other funds set aside for that purpose. But the railways cannot be certain that all costs will be covered. Would it not be a reasonable assumption that instead of putting more funds aside to cover more possible disasters, some of these funds be directed into safety measures? Safety may in the long run outweigh the cost of insuring against potential disaster.

It is not only the railways who may benefit from enhancing the safety deterrent. We all benefit. We enhance the quality of life, we reduce the cost of genetic damage, we reduce the cost of hospital care. In the longer view, we strengthen and protect our environment against chemical damage.

## LET'S BREAK THE ICE

We do not oppose the railways. We recognize the significant role the railways have played in opening the continent and contributing to the prosperity of our society. We know railways can provide "an economic, efficient and adequate transportation system . . . at the lowest total cost . . .".[1] We also appreciate the difficulties involved. Over the years the railways have faced many challenges. In most instances they have won public support.

Perhaps we can understand why the railways have become so strong-willed, autonomous and profit-minded and why in the process they are sometimes described as somewhat arrogant and aloof. It is a pity that they are not better understood and appreciated.

The railways, not unlike other major corporations, have shown occasional weakness in their community relations. In their search for maximum profit and cost efficiency, they seem to have lost sight of the fact that they must also serve the public interest. To do so is not always profitable. But failure to do so frequently results in a breakdown in communication and in public trust.

We suggest more frequent communication and public disclosure by the railways, specifically in those matters relating to railway safety.

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[1]National Transportation Act, 1967.

## SLOW TO RESPOND

The 1971 RTC rail-safety inquiry dealt with one aspect of public disclosure --in relation to accidents--and some progress was recorded. The subject was raised again at the Grange Inquiry in a broader context yet it is still an unresolved issue today.

The railways are in a strong position. They hold enormous economic power which can be exerted to dampen criticism and persuade compliance with their views. They maintain extensive information systems concerning their operations which are shared infrequently and often reluctantly. Hence, the public and even governments are forced to accept their calculations and conclusions. They retain and support a large network of experts and indeed may have reached a near monopoly position in railway-related skills. Experience shows that "one does not bite the hand that feeds one"--or at least not too hard.

Economic considerations have become paramount in evaluating operational improvements. Intangibles are frequently overlooked. Frequently, community leaders propose goals which the railways oppose strictly on the basis of economic argument.

## IS LIFE CHEAP?

We live in a materialistic society but surely cost-effectiveness is not the ultimate measuring stick for every issue. Is it perhaps that economic arguments are convenient and have predictable results that favour the railways? Or is it that life is cheap?

Let us look at a possible example involving evaluation of, say, the construction of railway bridges near a school. The life of a student, in legal settlement terms, may possibly be only worth $5,000. If a school of 500 students

were destroyed, the cost in insurance settlements may amount to $2.5 million. This may be compared to the high construction costs, such as in a railway overpass, which may total about $5 million. Hence, if one makes a decision whether to build the bridge strictly on economic terms, the answer becomes NO because it is cheaper to risk the lives of students. The example merely points out the precarious nature of a strict economic evaluation.

We believe the public should have some rights in the planning of railway projects. It is unfair that the railways merely impose impacts on the public for the benefit of the railways, shippers and industry. The community should have an opportunity to contribute to the proposals, or to point out the disadvantages.

We may quote from the RTC 1971 report following the safety inquiry: "The Railway Act makes it abundantly clear that Parliament intended Canadian railways to operate safely, and it gave the Commission all the statutory tools necessary to carry out the job of ensuring that they do. When statutory powers of the magnitude of those to be found in the Railway Act are conferred, private interest becomes secondary to the public interest, except to the extent that Parliament otherwise provides."

Although the RTC has far-reaching power, this has been used only infrequently to protect the public interest. Serious deficiencies were disclosed during the 1971 inquiry regarding railway safety. In one instance, the RTC discovered that the Canadian National and the Canadian Pacific had not filed accident returns for some 50 years and instructed the railways to remedy the deficiency. The RTC pointed out that the filing of annual returns of accidents

was a statutory duty, involving penalties for failure to comply. What is more shocking is that it took 50 years to discover this problem and remedy the solution.

Evidence at the Grange Inquiry confirms that the RTC has not been particularly effective in protecting the public interest. It became apparent at the inquiry that the RTC prefers to use persuasion in dealing with the railway and often acts as a role of protector of the railways from the public.

The RTC may argue that it lacks funds and staff. But we know the public has suffered. When it comes to railway safety and the transport of hazardous materials, it is clear that the RTC must exert its full powers. And the railways must show themselves as better neighbors to the communities through which they pass daily.

We urgently emphasize the need for railway involvement in community issues. Large corporations, particularly those that serve the public interest, should also take an active part in community relations and must solicit these views on issues that affect the public. Ontario Hydro has recognized this fundamental need of having the community participate and be involved in their planning process. It has discovered that coöperation can be invaluable and that frequently public distrust can be eliminated.

Unfortunately, the railways have been often un-cooperative and have forced their views onto the community in an insensitive manner. Speed restrictions on the North Toronto Subdivision were suddenly increased from 25 mph to 50 mph for freight trains and 90 mph for rail diesel cars, and traffic was

increased from 20 movements per day to 70 to 75 movements per day virtually overnight in 1964 with the opening of the Agincourt marshalling yard. Similarly, load limits were raised and train lengths increased. (Today's maximum speed is shown in Appendix VI). The public was simply expected to cope with the resultant impact. No move was made toward approaching residents living adjacent to the track to explain the changes and solicit community ideas to reduce their impact. Little effort has been made since by CP Rail to minimize the problems imposed on this community. Numerous requests from the public for help to improve conditions regarding safety and various nuisance factors are answered in an insensitive and at times in a cavalier manner.

During the current RTC hearings, it has become amply clear that the railways must relate more closely to the community from which they derive their revenues and which is served by their infrastructure. We hope to see results and a change in attitude.

## WHERE ACTION BEGINS

We have spent much time in discussion. The RTC exploratory process has been exhaustive. For those who have appealed for help, patience has been stretched. We need to act and the time for action is now.

What can the RTC do?

It can dismiss the entire Grange package as unrealistic. It can say to those who warn about spills and deaths that it is too bad but municipalities should have safeguarded their citizens through better zoning.

The RTC can turn its back on the school children who spend most of their days within a few dozen yards from the heavy traffic of lethal cargoes.

It can do these things and argue that the case has not been made for extra expenditures; for rail time lost; for possible traffic congestion; for possible slow deliveries in industrial chemicals.

It is a matter of judgement and a matter of conscience. It also is a matter of national responsibility.

We have sought to aid the RTC as best we can. Each side may have tried to impress its own views to the exclusion of others. We have sought a path through reasonable compromise. We have impressed on the RTC the need for urgency. We understand each party must have his time in court. It has been a tedious, painstaking process to which we hope we have made some slight contribution. And through the complex thread of legalistic argument we have noted the RTC's concern. Something must be done. What can we do?

1) Slow dangerous-cargo trains in critical high-density areas.

2) Improve train inspections before trains enter cities--the gateway concept.

3) Instal hot box detectors every 20 miles in built-up areas and every 10 miles in critical areas.

4) Emphasize roller bearings and tank-car improvements but not to the point of bankrupting the railways and the tank car owners.

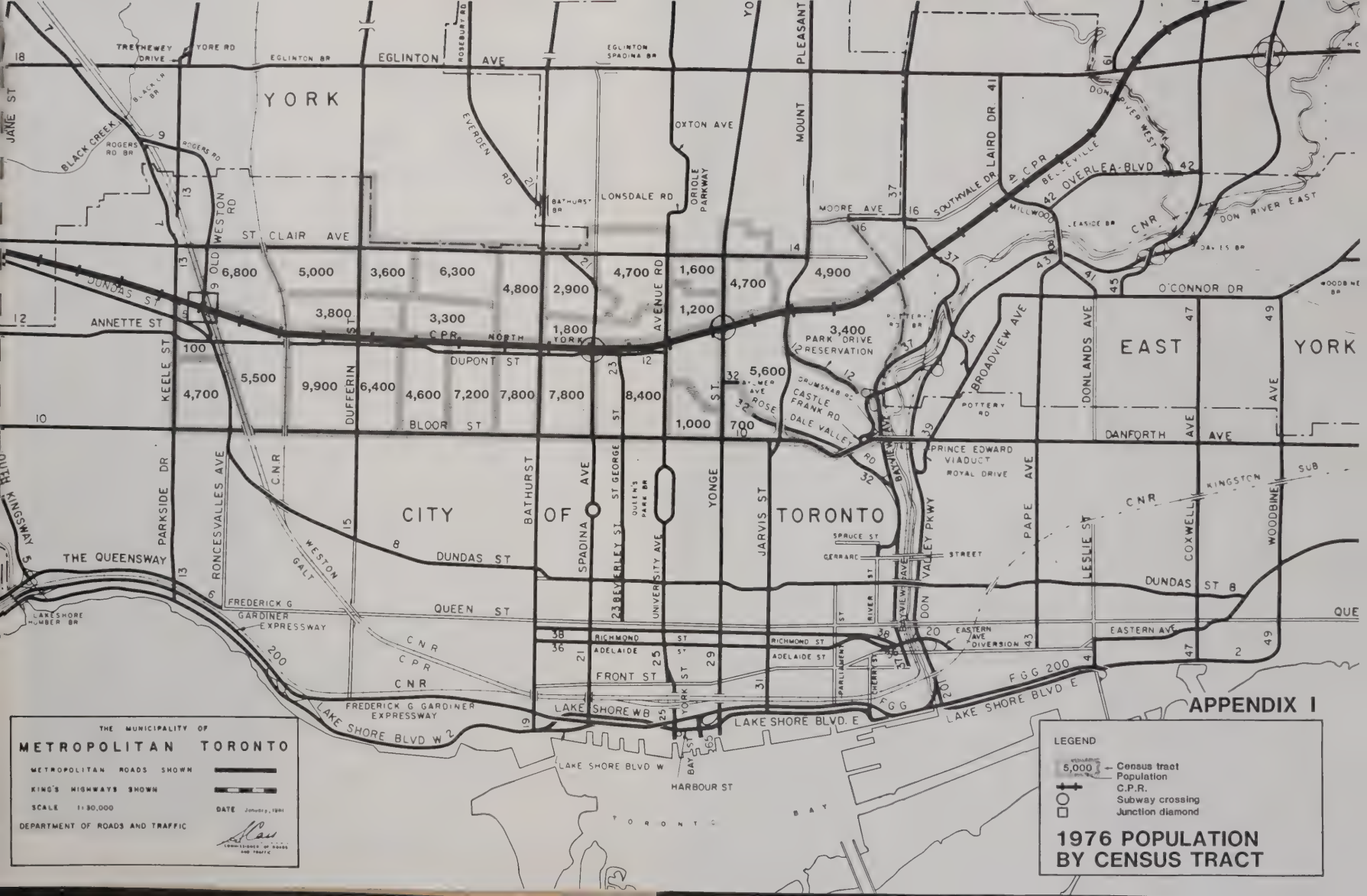
5) Pay greater attention to rail maintenance and vigilance.

We agree that safety involves costs. We argue that safety, within reason, is affordable. It is more than affordable, it is vital. We cannot accept the prospect of another Mississauga. We cannot afford to ignore the warnings of emergency response officials.

Finally, if the RTC does find that the railways and shippers simply cannot absorb the costs of at least the minimum measures of safety, the outstanding sums must be found by other means. Plainly, if the efficiency of the railways demonstrates they cannot absorb more of the costs, then it is a matter for Parliament to step in.

Our deepest concern is that action must follow this hearing. We cannot leave the fate of many thousands of people to mere chance.

- - -


YORK
CITY OF TORONTO
EAST YORK
EGLINTON AVE
ST CLAIR AVE
DUNDAS ST
ANNETTE ST
DUPONT ST
BLOOR ST
QUEEN ST
FRONT ST
DANFORTH AVE
O'CONNOR DR
OVERLEA BLVD
EASTERN AVE
LAKE SHORE BLVD W
LAKE SHORE BLVD E
HARBOUR ST
THE QUEENSWAY
FREDERICK G GARDINER EXPRESSWAY
DON VALLEY PKWY
PRINCE EDWARD VIADUCT
ROYAL DRIVE
CASTLE FRANK RD
DALE AVE
POTTERY RD
BROADVIEW AVE
PARK DRIVE RESERVATION
3,400
6,800
5,000
3,600
6,300
4,800
2,900
4,700
1,600
4,700
4,900
3,800
3,300
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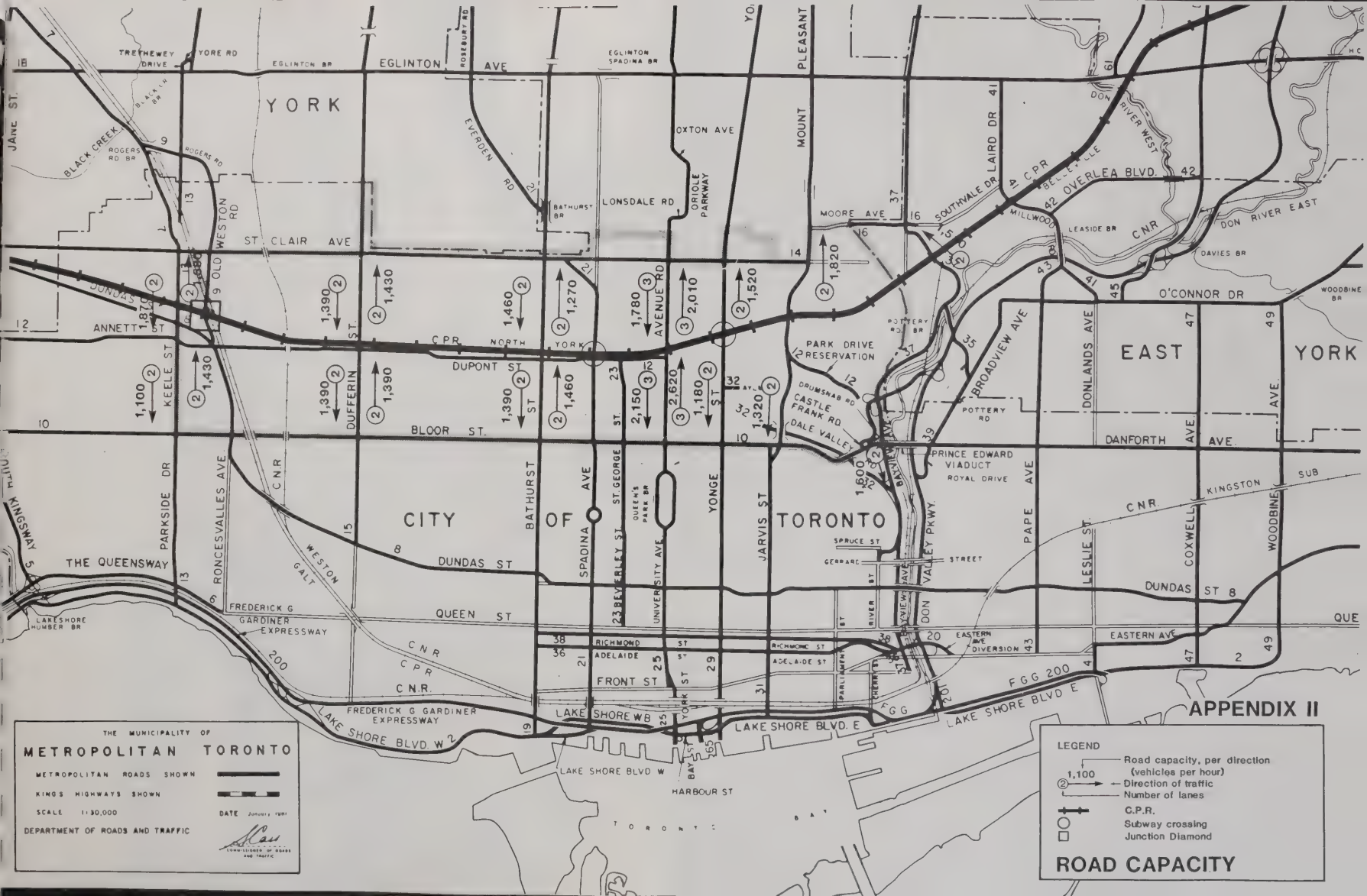
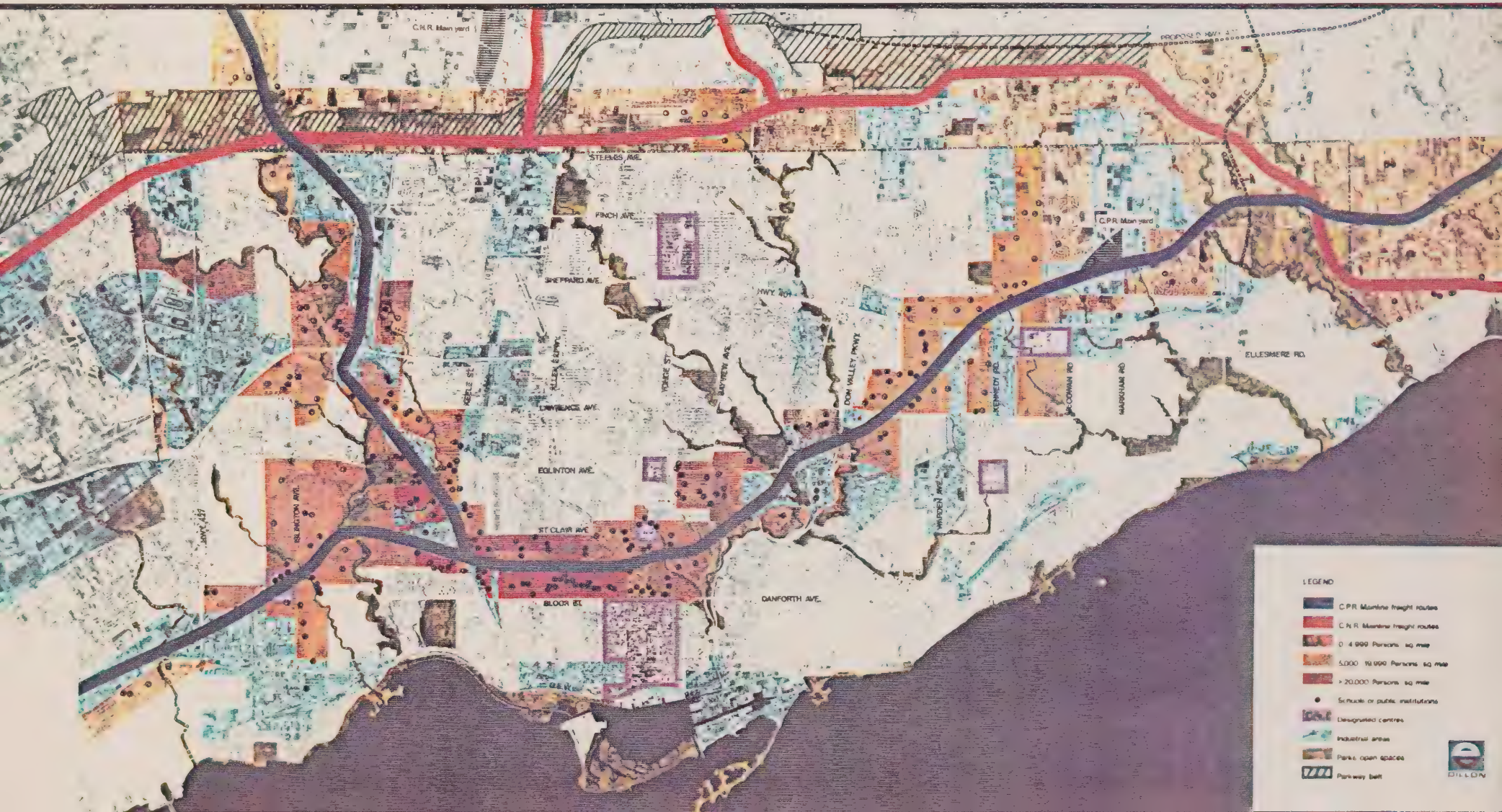
7,800
8,400
4,700
1,000
700
C.P.R. NORTH YORK
C.N.R.
C.P.R.
TORONTO BAY
THE MUNICIPALITY OF METROPOLITAN TORONTO
METROPOLITAN ROADS SHOWN
KING'S HIGHWAYS SHOWN
SCALE 1:30,000
DATE January 1, 1981
DEPARTMENT OF ROADS AND TRAFFIC
APPENDIX I
LEGEND
5,000 Census tract Population
C.P.R.
Subway crossing
Junction diamond
1976 POPULATION BY CENSUS TRACT


APPENDIX II
THE MUNICIPALITY OF
METROPOLITAN TORONTO
METROPOLITAN ROADS SHOWN
KINGS HIGHWAYS SHOWN
SCALE 1:30,000
DATE January 1961
DEPARTMENT OF ROADS AND TRAFFIC
COMMISSIONER OF ROADS AND TRAFFIC
LEGEND
Road capacity, per direction (vehicles per hour)
1,100
Direction of traffic
Number of lanes
C.P.R.
Subway crossing
Junction Diamond
ROAD CAPACITY
YORK
CITY OF TORONTO
EAST YORK
EGLINTON AVE
ST CLAIR AVE
DUNDAS ST
QUEEN ST
BLOOR ST
DUPONT ST
ANNETTE ST
LAKE SHORE BLVD E
LAKE SHORE BLVD W
FRONT ST
HARBOUR ST
FREDERICK G GARDINER EXPRESSWAY
THE QUEENSWAY
DANFORTH AVE
O'CONNOR DR
EASTERN AVE
PRINCE EDWARD VIADUCT
ROYAL DRIVE
DON VALLEY PKWY
BLACK CREEK
DON RIVER
C.N.R.
C.P.R.
TORONTO BAY

# LAND USES AND POPULATION DENSITIES ALONG RAILWAY CORRIDOR

MAP 1



Probe Post page 10 January-February 1980

# ECOTOXICITY IN CANADA

*Approximately 300 new chemicals appear on the market each year.*

*If each of these were screened for possible environmental and health effects, a judgement would have to be made on one chemical every 29 hours.*

*To adequately screen one chemical for health effects alone by present techniques requires two years of testing and costs an average of $250,000.*

By Dr. Donald Chant and Dr. Ross Hall

*The following article is an abridged version of* **Ecotoxicity in Canada**, *which originally appeared in the* **Canadian Environmental Advisory Council Annual Review 1977-1978.** *The* **Annual Review** *was released in December 1979. Dr. Donald Chant has served as chairman of the Pollution Probe Foundation's Board of Directors since the organization's inception in 1972. He is a Vice-President and the Provost of the University of Toronto. Dr. Hall is a professor with the Department of Biochemistry at McMaster University.*

In contrast to classical toxicology, which is the study of the harmful effects of single chemicals on individuals and populations of animals under controlled conditions, *ecotoxicology* is a discipline which studies the harmful effects of toxic agents and complexes of such agents on entire ecosystems. *Ecotoxicity* therefore is the impact of harmful substances on ecosystems, including, of course, their human inhabitants.

This disquietude about ecotoxicity, which gave rise to this report, arose from two major phenomena: rapid industrialization during an era of limited understanding of environmental impacts and of low public concern over environmental issues; and recognition of our ignorance of the biological and health significance of environmental degradation, which largely persists even today. The time lag between the arousal of environmental alarm and the accumulation of knowledge on which to base effective environmental protection can be very long indeed.

This concern was greatly heightened by analyses of the nature of what has been termed "the chemical sea" in which we live. Some 1.8 million chemicals have been synthesized by man, of which 100,000 are in commercial use. Of these, more than 10,000 are at annual production levels greater than 100 lbs. and 9,000 in excess of one ton per year.

Production of synthetic chemicals increases by about 7 percent per year. In North America alone in 1977, 160 billion lbs. of synthetic organic chemicals were produced, of which vinyl chloride, widely suspected as being carcinogenic, constituted six billion lbs.[1]

New chemicals are synthesized at a rate of about 25,000 per year, about 500 each week.[2] Of these, about eight per week are seriously considered for production, of which six actually reach production. Therefore, some 300 new chemicals appear on the market each year. If each of these were screened for possible environmental and health effects, a judgement would have to be made on one chemical every 29 hours. To adequately screen one chemical for health effects alone by present techniques requires two years of testing and costs an average of $250,000. Simple tests for predicting the probable environmental effects of new chemicals have not yet been developed.

Most of these synthetic chemicals are new to nature, which consequently has had no time to evolve the benign mechanisms necessary to deal with them. In contrast, nature has evolved defensive mechanisms against naturally-occurring toxic substances at the concentrations which normally occur in nature.

As with synthetic chemicals, statistics with regard to the refinement and use of naturally occurring toxic substances show a substantial and continuing increase. For example, in the 25 year postwar period, the use of mercury for manufacturing chlorine, a good index of chemical production, increased 40 times. All of these chemicals, in some form, in some way, eventually end up in the environment. Unlike other forms of wastes, waste chemicals permeate uncontrollably all living processes, including humans. The fat tissue of all Canadians, for example, has become a rich repository for fat-soluble environmental contaminants, from pesticides and flame retardants to industrial transformer fluids, all of which integrate into the metabolism of our bodies.

When we broaden our focus from the human body to entire ecosystems, our apprehension becomes even more acute. The essence of ecosystems is constant transformation. Nothing is static in a living organism or in the ecosystem as a whole. One of our major misgivings is the way in which foreign, man-made chemicals invade the bio-transformations of the ecosystems, becoming part of them. They move through the ecosystem in strange and unpredictable ways. For example, mercury, a naturally occurring metal, when discharged in unnatural amounts from industrial activities, is transformed by bottom-dwelling aquatic micro-organisms from its inert form to highly toxic methyl mercury

which is soluble in water. As this substance moves up in food chains, it becomes even more highly toxic, to the point where fish are too poisonous to be used for human food. Many synthetic organic chemicals are known to move similarly through food chains, from the well-known pesticide DDT and its relatives to more recently known substances such as PCBs and PBBs.

The toxic effects of chemical contaminants often manifest themselves in subtle ways in the organisms that constitute ecosystems: diminished reproductive capacity, deformed offspring, loss of ability to learn, and the increased evidence of tumors, to name some. Our concern stems from recognition that human survival and well-being depend on the living ecosystem of which we are a part. And we must ask ourselves: if chemicals are having these effects on other species, what are they doing to us?

Synthetic chemicals cannot remain neutral in the living process: a given chemical is either a nutrient or a poison. In the absence of precise evidence to the contrary, we must assume that all synthetic chemicals are poisons which can modify, often irreversibly, the growth and life of all organisms. There is no other prudent course.

The problem for our society is that once a chemical enters the environment, it is impossible to control or contain. It is changed, accumulated, carried literally everywhere by water and air. It may interact in ways almost completely unknown, with other contaminants and natural components of the ecosystem. (These are known as synergistic reactions.) It becomes integrated into the molecular processes of living organisms. At the moment, we have absolutely no laboratory approaches that can predict the fate and effects of a given chemical once released into the environment, let alone the fate and effects of complexes of chemicals. Moreover, we do not yet have a satisfactory system for monitoring these things in the natural environment.

Toxic chemicals enter our environment by three routes: by their deliberate use, such as for pest control; as wastes discharged incidental to some activity such as industrial production; and accidentally, such as the recent mixing of PBBs with cattle feed in Michigan, the release of dioxin into the atmosphere in Seveso, Italy, to avoid an explosion in a chemical plant, and the recent spill of PCBs in southern Ontario. Examples of chemicals entering the environment by these three routes are legion and well known.

The sharpening concern over environmental contamination by toxic chemicals has elevated a hitherto quiet and lacklustre science to international prominence and many new environmental policies are being based on it. That science is toxicology, and policies are being shaped on what toxicology is capable of doing. Unfortunately, traditional toxicology is not a good tool for uncovering or predicting the biological effects of chemicals.

The inadequacies of toxicology fall into four categories: 1) its methods of approach are based on the testing of single chemicals at relatively high dosages; 2) it has failed to develop animal models or other test systems capable of predicting the behaviour of chemicals in humans; 3) existing laboratory procedures are so labourious and time-consuming that only a few chemicals can be studied, and the cost is very high; and 4) toxicology is a laboratory science and offers little help in understanding the effects of toxic substances on the natural environment.

For one thing, traditional methods cannot determine the effects of *extremely minute amounts* of toxicants, either directly on health or on the ecosystem. And yet we know that very small amounts of some chemicals may have important effects. For example, diethyl stilbesterol, a chemical commercially fed to beef cattle, induced malignant tumors in laboratory mice at a level below the official analytical sensitivity of two parts per billion.

Furthermore, traditional toxicology cannot handle the element of *time*, especially when minute amounts of toxic chemicals are involved. And yet it is well known, for example, that many carcinogens do not cause cancer until 20 or more years after exposure. There may be similar time lags in the effects of toxic chemicals on ecosystems.

And finally, traditional toxicology cannot cope with determining and predicting the effects of *complexes of chemicals* on human health or on the assemblages of organisms that constitute ecosystems. We know, however, that we and our environment are exposed not to chemicals singly or in pairs, but in very large complexes — in fact, the "chemical sea." And we know that these combinations of chemicals may have effects that far exceed the sum of their individual effects, through processes such

as synergism where the presence of one chemical may greatly increase or modify the effect of another.

In dealing with environmental toxicity, two schools of thought have emerged. The first attempts to extend the methods and approaches of traditional toxicology to environmental problems. The second recognizes the inherent limitations of this science and is creating a new approach to the study of environmental problems — ecotoxicology.

Government legislation in the field of environmental contaminants is predicated on the first approach and is in danger of becoming as limited as the traditional science of toxicology.

Ecotoxicology, in direct contrast, deals with multicausal simultaneous effects of many substances, no matter how small the concentration, in the environment. The Scientific Committee on Problems of the Environment (SCOPE) has attempted to define an approach to ecotoxicology. Its project focusses on the living processes of the environment and it has defined six processes which can integrate the sum total of environmental effects.[3]

1. Basic biological responses to toxic agents;
2. Population influences of sublethal effects of toxic agents on individuals;
3. Use of aquatic organisms for determining the effects of environmental contamination (toxic agents tend to end up in water systems);
4. Effects of toxic agents on plant communities and the identification of plant species that are particularly sensitive indicators of contamination;
5. Effects of toxic agents on soil micro-organisms;
6. Study of geophysical systems: ozone, weather changes, global transport systems.

With traditional toxicology, humans conceptually remain separate from their natural environment and events in the environment cannot be related to their impacts on humans. With ecotoxicology, all living organisms, including humans, are treated as part of the system.

Attitudes towards environmental contamination can be separated into two perceptions. In the first, contamination is seen as incidental to chemical commerce. Pollution is a cost of using chemicals. This perception leads to a number of assumptions which are the base of present legislation: that contamination can be controlled at source; that traditional toxicology is a satisfactory base for making legislation; that some chemicals are more dangerous than others and should receive priority; that chemical contamination is inevitable and the best we can expect is to minimize its worst effects; that a certain amount of contamination can be tolerated provided that it is below a fancied "threshold" of harm; that humans are the centre of the biological world and the environment exists simply for us to use and enjoy.

In the second perception, the environment is viewed as a living ecosystem vulnerable to chemical intervention. Living organisms are the centre of attention and the objective becomes one of guiding the evolution of chemical usage so that it does not diminish environmental viability and quality.

If we had a strong scientific understanding of the ecological effects of toxic chemicals, it would be immaterial which perception prevailed because the scientific base for regulating chemicals would allow accurate and objective predictions of their effects. However, such is not the case, and with a grossly imperfect knowledge base, the perception within which environmental policy is shaped becomes all-important.

The Canadian federal *Environmental Contaminants Act* was proclaimed in 1976. It represents a major step in attempting to control chemical contamination of the environment. The Act empowers the Environmental Protection Service of the federal Department of the Environment to ban or restrict the use, manufacture and importation of any chemicals, singly or by class. Clearly the Act is based on the state of the art in terms of what is known, or can be known, about the biological effects of chemicals. It places emphasis on the use of evidence of environmental toxicity: evidence of poisoned fish, plants or animals will be used as a basis for rules-making. Such retrospective use of data in effect uses the environment as a laboratory and carries with it the assumption that environmental contamination is safe and can be tolerated until firm evidence to the contrary is accumulated and actual harm can be demonstrated. As pointed out earlier, it also assumes that the traditional toxicological approach of testing single chemicals for their immediate lethal effects is a sufficient tool for the control of environmental contamination.

It is unrealistic to believe that environmental contamination can continue in its present manner with just a little modulation here and there. As welcome as some legislative initiative is in this area, we believe the *Environmental Contaminants Act* must be considered at best as first-generation legislation and that the urgent task now is to proceed immediately with the development of second-generation legislation based on the principles of ecotoxicology.

Our concern about chemical contamination of the environment and the attempts of the Department of the Environment to deal with it fall into two categories:

1. The Environmental Protection Service lacks the resources to be able to administer the *Environmental Contaminants Act* effectively. The Department of the Environment, and Canada as a whole, desperately lack the trained toxicologists, especially ecotoxicologists, required to test all chemicals suspected of having harmful environmental effects. There seems to be little time or resolve to develop a Canadian initiative in this regard.

2. We return to our notion of the two perceptions of environmental contamination. The present Act is based on the chemist's perception, whereas the next Act should be based on an ecological perception. Onus should be placed on those who would change the environment to prove that such change is harmless.

The next Act should be positive in the sense that it actively urges the seeking of alternative technologies to avoid chemical contamination. All forms of chemical production and use need to be examined from two points of view. First, can alternatives that minimize the use of chemicals be devised? Second, if chemicals must be produced and consumed, can it be done with the "closed loop" approach? This is to say, in producing a chemical, methods for its disposal should be developed at the same time as methods for its production. Dumping chemicals in the environment, almost the only mode of disposal now used, cannot be tolerated any longer.

Lord Bertrand Russell wrote "One of the troubles of our age is that habits of thought cannot change as quickly as techniques, with the result that as skill increases, wisdom fades."[4] Many decision-makers in the field of environmental contamination will dismiss such wisdom as economically impractical at present and take the position that in any short term analysis perceived economic benefits must override environmental concerns. Perhaps one reason for this is that those who make policy and promote economic benefits see environmental concerns as being entirely negative — don't build this, don't use that. We would consider this report a failure if it leaves that impression. What we advocate are positive alternatives to present patterns of chemical use that are environmentally compatible. We are confident that everyone — citizen, industrialist, entrepreneur, politician wants to live in a stable, viable, healthy environment. We believe that the approaches we have proposed will serve the interests of us all.

The Canadian public is becoming increasingly sensitive to chemical contamination of the environment. On the surface, some of the fears expressed may seem to be irrational or overly dramatic, but they represent serious and legitimate concerns, sometimes well ahead of those expressed by the government and the actions it takes.

The present study has convinced the Canadian Environmental Advisory Council that the situation regarding chemical contaminants in the Canadian environment is critical and demands the highest priority for action. If action is not prompt and incisive, the situation will deteriorate to the point where the government will be forced to declare a complete moratorium on the introduction of new chemicals and the widespread banning of existing chemicals. The economic and political consequences of such emergency measures would be severe. But concern over the health of all Canadians and the well-being of the Canadian environment may leave us with no alternative.

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[2] Hamilton, R.D. *Aquatic Environmental Quarterly: Toxicology*. Fisheries Research Board of Canada Report No. 13, Ottawa, 1976, pp. 1-18.

[3] *Environmental Issues 1976*. Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU), August 1976.

[4] Quoted by John A. Knowles in *Doing Better and Feeling Worse*, Norton, N.Y. 1977.

## BURNING CHLORINE/PROPANE MIXTURES

Crude reaction scheme

$$57\ C_3H_8 + 240\ Cl_2 \rightarrow 454\ HCl + 144\ C + 4.3\ C_6Cl_6$$

(Propane) (Chlorine) (Hydrochloric) (Carbon (SOOT)) (Hexachloro Benzene)

$$2.5\ \text{gms}\ C_3H_8 + 7\ \text{gms}\ Cl_2 \rightarrow 16\tfrac{1}{2}\ \text{gms}\ HCl + 1.7\ \text{gms}\ C + 1.2\ \text{gms}\ C_6Cl_6$$

or, in "everyday" terms

10½ tons Propane + 70 tons chlorine

→ 7 tons carbon

\+ 68 tons hydrochloric acid

\+ 5 tons organochlorines (see other list)

under "ideal" conditions

---

* check gas for volatile organochlorines

i.e. the text-book reactions

* check SOOT for compounds other than $C_6Cl_6$

---

Prepared by: Professor Clive Holloway
York University

## Compounds Formed Relative to Hexachlorobenzene

(Major Component in all burns)

| Compound | Compound Burned in Chlorine | | | |
|---|---|---|---|---|
| | $CH_4$ | $C_3H_8$ | $C_3H_8C_yC\text{-}C_3H_8$ | $C_2H_2$ |
| Trichlorobenzene A | 0 | 0.001 | 0.002 | 0.003 |
| Trichlorobenzene B | 0 | 0 | | 0.001 |
| Tetrachlorobenzene A | 0 | 0.016 | 0.014 | 0.020 |
| Tetrachlorobenzene B | 0 | 0.012 | 0.006 | 0.013 |
| Hexachlorocyclopentadiene | 0 | 0 | 0 | 0.004 |
| "Tetrachlorobenzene C" | 0 | 0 | 0.002 | 0.009 |
| "Tetrachlorobenzene D" | 0 | 0 | 0 | 0.001 |
| Pentachlorobenzene | 0.073 | 0.223 | 0.164 | 0.068 |
| Pentachlorofulvene? | 0.068 | 0.042 | 0.041 | |
| Hexachlorobenzene (HCB)* | 1.000 | 1.000 | 1.000 | 1.000 |
| Octachlorostyrene | 0.001 | 0.025 | 0.010 | 0.063 |
| Tetrachloronaphthalene | 0 | 0.003 | 0 | 0 |
| Pentachloronaphthalene A | 0.002 | 0.004 | 0 | 0.001 |
| P Cl N "B" | 0 | 0.003 | 0 | 0.001 |
| P Cl N "C" | 0 | 0.001 | 0 | 0 |
| Hexachloronaphthalene A | 0 | 0.008 | 0 | 0.002 |
| H Cl N "B" | 0 | 0.002 | 0 | 0.001 |
| Heptachloronaphthalene | 0 | 0.010 | 0.004 | 0.007 |
| Octachloronaphthalene | 0 | 0 | 0.0006 | 0.007 |

* Previously used as a perticide
now banned because of toxicity and long term genetic hazard

Prepared by: Professor Clive Holloway
York University

## MAXIMUM TRAIN SPEEDS

| WESTWARD TRAINS INFERIOR DIRECTION | Miles from Leaside | NORTH TORONTO SUBDIVISION — STATIONS | Train Order Office Signals | Car Capacity Sidings | EASTWARD TRAINS SUPERIOR DIRECTION |
|---|---|---|---|---|---|
| NO REGULAR TRAINS | 00 | Two Tracks CTC ..... LEASIDE .....X | ..... | ..... | NO REGULAR TRAINS |
| | 15 | 15 MOUNT PLEASANT .....X | ..... | ..... | |
| | 34 | 19 ..... HOWLAND .....X | ..... | ..... | |
| | 55 | 21 ..... OSLER .....X | ..... | ..... | |
| | 59 | 04 .. WEST TORONTO .....X | ..... | ..... | |

NORTH TORONTO SUBDIVISION FOOTNOTES — PAGE 33



## NORTH TORONTO SUBDIVISION FOOTNOTES

MAXIMUM SPEED UNLESS OTHERWISE RESTRICTED ..... 50 M.P.H.

| Permanent Slow Orders | | Permissible Speed Miles per Hour |
|---|---|---|
| Mileage | Location | |
| 5.8 | Diamond West Toronto ..... | 20 |

Railway crossing at grade with C.N.R. at mileage 5.26–Interlocking; Rule 264 applies.

The junctions of the Galt Subdivision, the North Toronto Subdivision, the MacTier Subdivision and the railway crossings at grade with the C.N.R., the North Toronto Subdivision, and the MacTier Subdivision; at West Toronto–Interlocking. Interlocking limits extend between Galt Subdivision Signals 45, 45B, 62-1 and 62-2; MacTier Subdivision Signal 04; and North Toronto Subdivision Signals 57-1 and 57-2. Rule 264 applies.

Rules 263-273 apply, between Signals 2063-1 and 2063-2 at Leaside and Signals 62-1 and 62-2 at West Toronto. Exception to Rule 514 does not apply.

Main tracks are designated South Track and North Track.

Whistle signal 14(L) is prohibited approaching public crossings at grade between mileage 0.97 and mileage 5.9

To avoid blocking the crossing of Bartlett Ave., mileage 4.6, westward trains of over 55 car lengths should not pass Signal 45-1 or Signal 45-2 unless it displays an aspect less restrictive than Rule 285, Approach Signal.

The ringing of the engine bell approaching the following public crossings at grade is prohibited: Bartlett Avenue, mileage 4.6 and Osler Avenue, mileage 5.7.

Movements over public crossings on Old Bruce Lead at Cariboo and Osler Avenues must be protected by a member of the crew.

Special Instruction "D" applies at:

| | |
|---|---|
| Mileage 4.64–Ontario Lumber | –North Track |
| Mileage 4.91–Presto-Lite | –North Track |
| Mileage 4.98–General Electric | –North Track |
| Mileage 5.4 –Aulcraft Paint | –South Track |

Special Instructions governing movements within the limits of the Toronto Terminals Railway Company, see page 54 and 55.

APPENDIX VII

# SYSTEM SAFETY OVERVIEW

# RAIL TRANSPORTATION

WORKING PAPER
TO
ONTARIO TASK FORCE
ON PROVINCIAL RAIL POLICY

BY

PETER D. NOLL

MINISTRY OF TRANSPORTATION
AND COMMUNICATIONS

DANGEROUS GOODS
TRANSPORTATION OFFICE

1981

## EXECUTIVE SUMMARY

Jurisdiction of the Canadian Transport Commission has been reviewed to determine the extent of duties and powers.

-It is found that adequate powers to administer the railway transportation system have been delegated to the Canadian Transport Commission and the Railway Transport Committee.

The structure and organization of the Canadian Transport Commission and Rail Transport Committee have been reviewed.

-Problems have been identified:

The measures undertaken by the regulatory body in response to the 1970 Inquiry into Rail Safety, have not been substantially effective in improving the level of public safety in line with reasonable expectations.

The regulatory body's low-key profile in using its extensive powers affirmatively, seems to result in slow progress in improving the level of public safety.

The regulatory body's extensive reliance on self-regulation by the railway companies does not seem to have produced substantial improvements in the level of public safety, in line with reasonable expectations.

The regulatory body's response to the aging of the technology employed in the Canadian railway infrastructure and rolling stock, does not seem to provide adequate and timely compensating measures to maintain a level of public safety in line with reasonable expectations.

The regulatory body seems to be slow in assessing opportunities for constructive changes to the rail transportation system which may result from technological innovations. Its level of response to such opportunities does not seem to actively encourage substantial and timely upgrading of the rail transportation environment, to achieve improved public safety.

Substantial work seems still to be required (some of it in progress) to compile minimum standards and criteria for certain vital aspects of the rail transportation environment, which could form the basis for affirmatively regulating a uniform level of safety even within the constraints of the status quo.

The CTC's ability to protect its research and development staff complement is being limited and because of constraints, subject to priority ranking by management.

There may be a conflict of interest confronting the regulatory body and its administrative staff, as they conduct accident investigations and may subsequently be required to act as a judiciary body.

Enforcement has been reviewed

-Problems have been identified:

In context with the geographic distribution of the rail transportation system in Canada and reasonable expectations regarding the level of public safety, the number of enforcement officers today is not adequate for ensuring sufficient supervision of compliance with existing CTC regulations.

The CTC's obvious reliance on railway company management to police those aspects of rail transportation which have a direct bearing on the level of public safety has not resulted in substantial improvements in this area.

There are a number of sources of recognized stature and authority in railway matters, which have interpreted respective available data to indicate a deterioration in the level of public safety.

There is a documented lack of responsive attention and follow-up action by the regulatory body, to a large number of long standing enforcement related complaints from within the railway operations environment. These complaints are in relation to the railways' internal inspection and corresponding maintenance practices for system components, which directly contribute to operations safety and therefore bear on the level of public safety.

The CTC's obvious reluctance or lack of ability to pursue violations of its regulations through prosecution, is not likely to establish a climate of high-profile attention to public safety in railway management. (Selective enforcement and prosectuion can be a useful tool to focus priority attention on system wide deficiencies in those areas which can be identified to have a significant detrimental impact on public safety.)

The CTC's ability to protect its enforcement staff complement has been limited due to constraints imposed by government.

The CTC's ability to attract suitable personnel to its enforcement staff positions is limited by conditions which seem to favour personnel from the railway management classes and by unattractive levels of compensation.

System Safety has been reviewed

-Problems have been identified:

The data show that the absolute hazard generated by the rail transportation system to the Canadian public:

1) rose sharply in 1979 due to derailments
2) rose sharply in 1979 due to collisions
3) rose sharply in 1979 due to the presence of dangerous goods
4) declined slightly in 1979 relative to crossings

The Railways' Safety Program has been reviewed

-Problems have been identified:

Railway management has not succeeded in balancing the economic performance objectives with public safety objectives, to satisfy reasonable public expectations; or has failed to correctly identify or appreciate these expectations.

Railway management has biased decisions relative to operations, with strong thrusts towards more payload per transportation unit (i.e. larger cars with greater carrying capacity, longer trains, etc.), with considerable impact on the aging technology of the infrastructure, rolling stock and the traffic control and monitoring systems (i.e. greater wheel contact and impact loads, limitations on in-transit visual monitoring of running gear, etc.)

Upgrading and maintenance of the infrastructure, rolling stock, control and operating systems appear to be out of step with the demands of traffic to the extent, that reasonable public safety expectations are not being met.

Railway management is at the same time transforming the operations, infrastructure, traffic control and rolling stock monitoring and maintenance systems away from traditional staff intensive procedures. Replacement systems have been integrated relatively successfully in some instances, in others, existing systems are being curtailed or eliminated. Management of this process is not maintaining safety levels in line with reasonable expectations.

Current initiatives at the federal government level have been reviewed and their probable effect has been assessed:

The outlined federal level initiatives will have a moderate impact on absolute rail safety, due to intermodal compatibility of specifications, standards, documentation and responsibilities.

The regulatory terminology, which is in line with the Canadian standard and judicial interpretation, should ensure uniformity in judgements. Precedents established in the Courts in context with Canadian social standards and levels of expectation should ensure high levels of compliance.

The specific mandate of the Transportation of Dangerous Goods Branch of Transport Canada should cause sufficient profile to ensure resource allocations, and responsiveness to changing public expectations.

In turn this should cause upgrading of the mechanisms that ensure public safety in the transportation of dangerous goods, reasonable in step with expectations.

Opportunities for Ontario action are identified:

-A policy to ensure rerouting of dangerous goods rail traffic around Ontario population centres and restrictions on land use within a wide corridor about the rail line.

-A policy to cause dangerous goods cargoes to be consolidated in special trains (where practicable) and imposition of constraints on train operations, in terms of any one or all of route, time and speed; optionally combined with publication of traffic time tables.

-A policy to cause segregation of dangerous goods cargoes according to potential hazards due to the properties of the dangerous goods and imposition of constraints on operations which specifically address the dangerous properties of the cargo; optionally combined with the publication of traffic time tables.

-A policy to ensure limitations on quantities of dangerous goods cargoes, depending on the potential hazards due to the properties of the dangerous goods, combined with measures outlined in the other options.

-Moral suasion of the Ontario Government through the federal Minister of Transport to cause a change in CTC's regulatory and enforcement philosophy and moderation of constraints on the agency.

-In negotiation the implementation of the Transportation of Dangerous Goods Act in Ontario; the adoption of a negotiating stance which would cause the transfer of accident investigation responsibility from CTC to the Ministry of Transport.

-A negotiating stance which would provide the Ontario Government with qualified resources to ensure compliance with regulations in railway transportation, combined with a thrust to include minimum standards and performance criteria for rail cars transporting dangerous goods in regulations under the Transportation of Dangerous Goods Act.

-Investigation of the possibility of enforcement of appropriate existing Ontario legislation and regulations protecting the environment, labour, agricultural land, etc., on grounds, that conditions or actions within the railway right-of-way, on land of the Crown in Right of Ontario, violates such legislation and regulations; or the development of respective specific legislation.

-Moral suasion of the Ontario Government directed at railway management to increase the bias towards public safety objectives (as identified by the Ontario Government from time to time).

-Moral suasion of the Ontario Government to slow or reverse the trend of system changes from traditional staff intensive monitoring, maintenance and operations procedures for train consists of carrying of dangerous goods, until replacement systems are designed and proven to significantly reduce the level of absolute hazard to the Ontario public.

-Moral suasion of the Ontario Government and/or publication of criteria, to cause priority upgrading of infrastructure, rolling stock, control and operating systems in corridors where dangerous goods are transported, to such standards and performance criteria as required to ensure public safety objectives (as identified by the Ontario Government from time to time).

The development and publishing of Ontario Government safety improvement criteria for rail transportation directed at reducing the absolute hazard within a defined time frame and modified from time to time, to reflect reasonable public safety expectations as identified by the Ontario Government; and publication of information on compliance.